

# Detector initiatives at the APS

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Advanced Photon Source

# Detector initiatives at the APS

- Detector pool
- Detector development

# APS Detector Pool Mission

increase quality and efficiency  
of experiments at the APS by:

- providing a broad range of detectors
- making expensive detectors available
- increasing efficiency of detector usage

# APS detector pool, 2002

- First APS/User Strategic Planning Meeting May
- APS detector pool (DP) was created May
- Detector pool budget FY 2002 (\$200K) June
- Detector pool questionnaire June
- Detector pool budget FY 2003 (\$676K) Nov
- Presentation of the DP at the TWG meeting Nov
- DetectorSync questionnaire Nov
- List of detectors for purchasing Dec

# APS detector pool, 2003

- Acquire, characterize and maintain detector pool detectors
- Provide detector expertise and troubleshooting support
- Provide available detectors
- Evaluation commercially available and novel detectors
- Set up laboratory for detectors testing and development
- Detector pool web database
- Represent the APS community in interactions and information exchange with other US and international facilities

# List of detectors

Item	Type	Vendor	Model	Qty
1MPixel High-res camera	Area, CCD	Roper Scientific	CoolSnap HQ	1
4MPixel FO System	Area, CCD, FO	MAR	MAR 165	1
Ion chambers	Current	Oxford		4
YAP/NaI	Counting	Bicron/Oxford		2
KETEK	Energy dispersive	KETEK	AXAS-SDD	2
Phot. Img.	Energy dispersive	Phot. Img.	Vortex	2
Canberra Ge, 13-elm.	Energy dispersive	Canberra		1
Canberra Ge	Energy dispersive	Canberra		2

# APS priorities for detector developments

Detector	Project	Specs	Sectors	Experiment
Fast area	CCD	>100 f/s, 2Kx2K, 10-20 um, 12-16 bit x-ray, visible	1,2,5,8,13,20	Time resolved tomography and radiography, X-ray Photon Correlation Spectroscopy
Ultra fast area	CCD	>500 f/s, 1Kx1K, 8-12 bit, x-ray, visible	1,5,7,8	Ultra-fast radiography, X-ray Photon Correlation Spectroscopy
Super fast area		1 us, x-ray	1,12,18	Time-resolved SAXS
High res., high eff. area	Pixel	1-6 um, x-ray	1,2,4	X-ray micro-diffraction
Low res.(large area), high eff. area	Pixel	>100x100, 100-200 um, EDD(>10%), x-ray	1,13,14,16,18	Time-resolved radiography, Surface scattering
Multi-element, high CR, large solid angle EDD	SDD, pixel	150-200 eV at 6 keV	2,4,7,13	X-ray microprobe - Fluorescence
Large area		300x300 mm, 1sec, low noise, 10-100 keV	1,14,16	High energy stress/texture, time resolved powder diffraction
High res. EDD	STJ, calorimeter	10-20 eV at 10 keV, 100 eV at 80 keV	1,2,13	Energy dispersive diffraction, Compton scattering, XANES
High res. Spectrometers	multi-crystal, large NA, Bragg/Laue		20	
Multi-element APDs			1,20	Time-resolved radiography

# APS users detector development

P. Falus, M. Borthwick, S. Mochrie, IMMYH-CAT

Direct detection CCD for XPCS. Dalsa Dalstar 1M60 can continuously read out up to 60 frames per second. Based on a 1024x1024 CCD frame transfer chip. Camera was modified to be cooled.

# APS detector developments

J. Liu and J. Wang, XFD, APS, ANL; A.G.MacPhee, LBNL;  
B.Shan, Z.Chang, J.R. Macdonald Lab., Kansas State University

A multi-shot accumulation x-ray streak camera with 0.6 ps temporal resolution

S. Ross, J. Carwardine, ASD, APS, ANL

Low noise electrometer for PIN-diode x-ray beam position monitor. Currently being installed at sectors 13,17,32, and is going into 10 other sectors. Low cost, pA sensitivity at kHz bandwidth amplifiers, interfaced with EPICS

# Future detector developments

DetectorSync - ALS, EED, LBNL; APS, ANL; SSRL, SLAC

Pixel detector array development

S. Ross, J. Carwardine, N. Arnold ASD, APS, ANL

Development of high frame rate area detectors (CCD, CMOS based)

Research and development on avalanche photodiode (APD) detectors and arrays, for time resolved studies

Photon Imaging, Inc. - NIH SBIR, development of 1-mm-thick silicon drift diode (SDD) energy dispersive detector; SBIR, development of multi-element SDD detector

J. Johnson, MSD, ANL; R. Weber, Containerless Research, Inc.;  
S. Schweizer, MIT

Development of advanced high resolution area x-ray detector, based on photo- stimulated luminescence glass

# Conclusions

## Recent and future detector activities at the APS:

- Detector pool
- Detector related user support
- Refine specifications for detector development
- Enlarge in-house detector development program
- Support and participation in detector development programs outside APS
- Collaboration with detector groups from other Synchrotron Radiation facilities
- Collaboration with companies on detector development